Washington State Department of Transportation

Construction Traffic Mitigation Demand Management Evaluation

I-405 Kirkland Nickel Stage 1

Public Transportation Division

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Washington State Department of Transportation

I-405 Kirkland Nickel Stage 1 Construction Traffic Mitigation Demand Management Evaluation

In 2006 and 2007, construction for the I-405 Kirkland Nickel Stage 1 Widening Project narrowed lanes, reduced shoulders and performed construction that was visible to drivers. WSDOT's Public Transportation Division worked with the I-405 project team and local agencies to design a plan that:

- Reduced single occupancy vehicle (SOV) trips in the I-405 corridor
- Leveraged WSDOT's resources
- Measured performance and documented lessons learned about transportation demand management (TDM) implementation for future construction projects

The resulting TDM plan helped keep people and goods moving while crews completed construction and allowed WSDOT to comply with commitments listed in the I-405 Corridor Program Final Environmental Impact Statement and Master Plan.

Investment Strategy	Total Cost	Vehicle trip reduction daily round trips Actual	Implementation Timeline	Total one-way trips reduced during project	Average daily cost per one-way trip reduced
Add transit service	$1,679,868	427	6/2006 - 5/2008	427,000	~$3.9
Promote HOVs	$121,000	92 [1]	5/2006 - 7/2007	57,500	~$2.1
Relocate vanpools	$16,800	42	5/2006 - 5/2007	22,750	~$0.7
Install and promote bicycle lockers	$12,500	4	Installed January 2007	1,667	~$7.5 [2]
Promote vanshare	$0	0	6/2006 - 10/2007	0	-
SUBTOTAL	$1,830,168	565		508,917	~$3.6 [3]
Commute trip reduction	-	333 [4]	3/2006 - 10/2007	277,500	-
Vanpools	-	167 [4]	3/2006 - 10/2007	139,167	-
TOTAL	-	1,065	-	925,583	-

[1] Trip reduction estimate is based solely on additional transit use attributed to promotion (not including the added transit service). We were not able to measure the additional carpoolers so this estimate does not fully represent the benefits of this program.

[2] Bicycle lockers remain at the park and rides for use after construction. Trip reduction and daily cost calculations are based on the construction period ending October 2007.

[3] Average cost per trip for activities directly funded for construction mitigation.

[4] These programs are ongoing and statewide in nature and were not specifically implemented to support I-405 construction traffic mitigation. The estimates are representative of the I-405 corridor and the change from before to during construction.

Before the I-405 corridor construction was underway, WSDOT's initial analysis of the construction plan suggested that a workday reduction target of about 1,560 SOV round trips needed to be removed from I-405 to maintain pre-construction traffic flow. Through subsequent refinement of the analysis methodology, a more appropriate target would have been about half this number of workday round trips.

The projects implemented specifically to support I-405 construction traffic mitigation reduced 565 daily round trips. However, ongoing, statewide CTR and vanpool programs reduced an additional 500 daily round trips on the I-405 corridor, totaling 1,065 trips removed.

The lessons we learned will be applied on future construction projects, including those on the I-405 corridor, SR 520, and the Alaskan Way Viaduct. In addition, we leveraged existing state and local TDM investments to make the most of limited resources.

Traffic analysis of the corridor revealed high-density travel patterns between north King County and Redmond. As a result, the mitigation plan was built around new transit capacity between these areas. To support this new transit service, WSDOT developed a secondary strategy of freeing parking spaces in park and ride lots along the I-405 corridor. The demand management programs were targeted to reduce demand during the 2006 and 2007 construction seasons, though some activities continued through spring 2008.

Measuring performance

The objectives of the mitigation investments were to reduce vehicle trips on the corridor during construction and to maintain traffic flow through the construction zone. Performance measurement focused on identifying the effects of individual transportation demand management activities.

We planned to use traffic loop detector data to measure the speed and volume of traffic through the construction zone for comparison with pre-construction traffic flow data and trip reduction targets. Although a loop detector does not capture vehicle occupancy, it can distinguish between the general purpose lanes and the high occupancy vehicle (HOV) lanes. This would have also allowed us to compare general changes in the volume of traffic in the general purpose and high occupancy vehicle lanes to estimate carpooling. In theory, as the demand management investments took effect, the HOV lane usage should have demonstrated a relative increase. However, WSDOT was unable to measure I-405 traffic within the work zone because construction and shifts in traffic lanes made the traffic loop detectors inoperable and the replacement traffic detectors did not work. Existing loop detectors outside of the construction zone were too far away to capture the performance of traffic flow through the construction zone.

While this lack of traffic data prevented measurement of some individual demand management projects and hindered our ability to measure overall program performance, we were able to report performance of most of the activities through other measurement methods.

Lesson learned

1. Develop a viable plan to measure traffic flow during construction

Traffic flow data is needed on an ongoing basis during construction primarily to help WSDOT traffic flow engineers manage the highway system and provide real-time traffic and travel time data to drivers and news reporters. This data is also used to help measure the performance of traffic mitigation projects.

It is difficult to keep traffic loop detectors functioning in a construction work zone.

In many instances, the devices and fiber optic lines that connect them to WSDOT's network must be removed or cut in order for the crew to complete required construction work. In addition, construction-related traffic shifts often temporarily redirect traffic around loops.

Because it is difficult to continuously provide traffic flow data during construction, contractors sometimes ask WSDOT project offices to remove this requirement after construction is underway. Project engineers consider these requests in the context of overall costs, benefits and competing interests, including the project schedule and budget. They may sometimes agree to this change as a tradeoff for contractor concessions.

During the I-405 Kirkland Nickel Stage 1 project, the contractor asked WSDOT's project office to allow them to remove traffic loop detectors and instead use another device to provide traffic flow data. This device failed and the requirement was not enforced.

WSDOT should continue to strategically develop plans to provide ongoing traffic flow data during construction. We should include traffic flow measurement contingency plans in project management plans if loop detectors are at risk during construction. Plans that include other traffic-counting technologies should be tested in advance to confirm their capabilities and compatibility with WSDOT's existing system. When contractors request changes to the traffic data collection during construction, WSDOT's construction project offices should engage other groups within WSDOT, for example, traffic operations, communications and public transportation, to work collaboratively to develop solutions that will maintain traffic flow data and consider costs, benefits and risks associated with disrupting this data.

Traffic data is also important to before-and-after assessments that measure a project's benefits. Staff from the Public Transportation Division, Headquarters Traffic, Northwest Region Traffic, Olympic Region Traffic, the Transportation Data Office and Program Management are coordinating efforts to measure project performance before, during and after construction. These efforts improve the efficiency of our data collection and concentrate resources where they are needed most.

Trip reduction targets

Trip reduction targets were not set in advance for the individual demand management activities in the plan. Because individual targets were not set, we could not assess whether or not individual program activities were meeting objectives during implementation. Consequently, our ability to adjust programs during the project was significantly reduced.

Lessons learned

2. Use updated methodology to set trip reduction targets

We have developed a more appropriate methodology to establish trip targets and used this method for I-405 construction traffic mitigation plans for 2008 and 2009.

This new methodology is being applied to other projects such as the Columbia River Crossing to establish performance targets.

3. Set trip reduction targets for individual program activities

Performance targets for individual investments are essential. The targets allow an assessment of investment performance during a project, which enables WSDOT to make interim adjustments and consequently maximize the effectiveness of our demand management. This will also allow us to build a more comprehensive body of knowledge about transportation demand management and construction traffic mitigation while continuing to improve program planning and overall effectiveness.

Add transit service

After analyzing traffic patterns, park and ride capacity, transit operations and potential markets, WSDOT decided to pay King County Metro to start the new transit Route 644 with 18 daily runs and extend eight daily runs on existing Route 255 (see attached maps) from June 2006 through May 2008. The bus service operated Monday through Friday during rush hours and improved transit connections within the Kirkland, Totem Lake and Overlake areas.

Results

On average, WSDOT-sponsored bus service removed 427 daily round trips. Route 644 ridership started low when it began in 2006 and built steadily over time. In February 2007, WSDOT and King County Metro reduced Route 644 from 18 to 15 transit runs by removing buses with the lowest ridership (early in the morning and late in the evening) due to budget constraints. However, ridership continued to increase during construction on the remaining 15 runs. Gas prices, parking prices, travel times, availability of transit, park and ride availability, overall economic climate and convenience also likely influenced transit ridership growth.

Ridership grew so significantly that after construction was done and state funding for bus service ended, Redmond and Microsoft partnered with King County Metro to continue funding for Route 644 (now known as Route 244). The extension of Route 255 ended in September 2008 because funds weren't available to continue the service.

Lessons learned

4. Start early and plan ahead

In order to have transit service in place for mitigation activities, King County Metro may need at least six months to procure equipment and to hire and train operators. New transit routes may also take up to three years to reach productive ridership levels. In addition, any changes made to a transit service must align with service change dates, which occur three times annually. Transit service may not be a suitable strategy for many construction traffic mitigation projects based on the long start-up time.

5. Carefully consider the effect of temporary transit service on riders

Consider the pros and cons of adding additional transit options. Once riders arrange their lives around a transit route, it's problematic to take it away. Riders incorporated the extended Route 255 into their daily schedules, and later loudly voiced their concerns to King County Metro when they learned that the route would be eliminated when the construction project was completed.

6. Carefully consider transit service for construction traffic mitigation

Transit service can have a higher cost than other trip reduction options and may be a cost-effective option only in corridors with a significant need for trip diversion, high amounts of traffic, robust transit infrastructure and concentrated home and work markets. Adding transit service to an existing established route (as Metro did with Route 255) during short-term, high-impact construction projects may be worthwhile if equipment and staff are available. Another example of expanded during short term high impact construction is Sound Transit's temporary additional Sounder commuter rail train service during the 2007 I-5 construction closures.

Promote high occupancy vehicle use

WSDOT hired King County Metro and communication consultants at PRR to:

- Produce and deliver a construction information booklet including four free bus ride tickets and a postage-paid return questionnaire to provide feedback on transit services (Metro donated the tickets and the postage-paid questionnaire)
- Produce and place 150 bus-side advertisements
- Produce and place eight print advertisements in newspapers
- Place information on WSDOT and partner Web sites

In late June through July 2006, the booklets were mailed to 94,000 households and businesses within a 2.5 mile radius of park and ride lots near the construction zone. Thousands of booklets were also distributed at fairs and festivals in east King County.

From December 2006 through January 2007, the WSDOT-funded bus routes were promoted in newspapers including the weekly Bothell/Kenmore Reporter and Kirkland Courier, and the daily King County Journal (to zip codes in Bellevue, Redmond, Kirkland, Bothell and Kenmore). In addition to distributing print material, WSDOT added project information on its Web pages and e-mailed information to WSDOT's I-405 Eastside subscribers.

The bus side advertisements were not implemented since King County Metro could not guarantee that they would be placed on routes that traveled through the construction zone.

Results

Approximately 23,300 of the 408,000 free bus ride tickets distributed were redeemed, resulting in a six percent redemption rate. Redemption rates for previous King County Metro promotions ranged from 12 to 28 percent. Eight hundred questionnaires were completed and returned. Forty-five percent of the respondents mentioned Route 255 and five percent mentioned the newly established Route 644. Analysis shows that the promoted bus routes experienced a higher increase in ridership on average (13 percent) than other eastside routes that were not promoted (9 percent). The four percent difference in these percentages equals a reduction of 92 trips that we attribute to the promotional activities. Other factors—gas prices, parking prices, travel times, availability of transit, park and ride availability, overall economic climate and convenience—likely also influenced transit use.

Resources did not exist to conduct consumer market research which would have helped to measure the marketing campaign's overall effectiveness. We were also not able to measure additional trip reductions that were achieved through e-mail messages to subscribers, press releases, newspaper advertisements, WSDOT project Web pages and information provided on partner agencies' Web sites. The plan for measuring these trip reduction efforts relied upon traffic measurement plans on I-405, which were not successfully implemented.

Lessons learned

7. Design direct mail to convey a clear call to action

We believe that the booklet lacked focus. It included extensive amounts of detailed information about the construction project and transportation and travel options, services, and resources. The lower redemption rate of the free bus ride tickets, which were located in the center of the nine-page booklet, indicates that many people may not have noticed the free bus ride tickets within the large quantity of information.

8. Consider consumer market research to measure marketing effectiveness

In instances where significant resources will be invested in consumer marketing and public information, consider providing funds for consumer market research to help measure performance, support accountability, build our body of knowledge and improve future outreach efforts.

9. Continue to improve traveler information and rideshare matching systems

The next generation of traveler information systems should integrate traffic information as well as information about travel options and rideshare matching. These systems will eventually allow more targeted marketing, such as incentives for travelers on specific corridors. WSDOT's Public Transportation Division is working with partners including King County Metro to develop the next generation of RideshareOnline.com a statewide ridematching system.

Relocate vanpools

WSDOT contracted with King County Metro to relocate a minimum of five vanpool groups who used three crowded park and ride lots serving the I-405 corridor. King County Metro sent relocation offers to 17 vanpool groups at the Brickyard, Kenmore, and Kirkland park and ride sites.

WSDOT and King County Metro analyzed traffic, park and ride capacity and transit services in the area and determined that vanpools could be relocated from the overcrowded Brickyard park and ride lot, which offers transit service, to park and pool lots that do not offer transit service. This would provide additional parking for transit users while maintaining vanpool participation. Vanpoolers were offered financial incentives to switch to park and pool lots.

Results

Six vanpools (50 passengers and six drivers for a total of 56 people) accepted the relocation offer for one year from May 2006 through May 2007. This freed up parking stalls for new transit users. King County Metro's Quarterly Park and Ride Utilization Reports between May 2006 and May 2007 showed that on average, 42 of the 50 stalls were filled. We spent $16,800 to relocate six vanpools (56 people). It costs about $25,000 to construct a single parking space. We do not know if these people returned after the one-year commitment.

Lessons learned

10. Relocating vanpools is a relatively inexpensive way to add park and ride space

It costs less to relocate vanpools than to construct a single parking space (which is about $25,000).

11. Freeing up space at crowded park and ride lots encourages more ridesharing (through transit, vanpool or carpool)

King County Metro's Quarterly Park and Ride Utilization Reports showed that most of the vacant parking stalls created by the vanpool relocation were filled.

12. Vanpool relocation can be done relatively quickly

Vanpool relocation can happen quickly with most vanpoolers relocated in less than 30 days, from start to finish. This includes the time for vanpoolers to consider and respond to the relocation offer.

Install and promote bicycle lockers

WSDOT hired King County Metro to install lockers for four bicycles at the Kenmore Park and Ride (doubling the capacity) and lockers for four bicycles at the Brickyard Park and Ride where none existed before. This strategy can increase the efficiency of the park and ride lots. Local permitting processes delayed final implementation. The bicycle lockers became available by February 1, 2007. Bicyclists sign up for a locker with King County Metro and provide a refundable deposit but there are no use fees.

Results

Adding the bicycle lockers removed four daily single occupant vehicle trips and freed up parking space for transit riders. The lockers were installed in January 2007. The first Brickyard Park and Ride locker was rented in February 2007. In May 2007, six of eight lockers were filled at the Kenmore Park and Ride. All lockers were full by July 2008, with people on the wait list. WSDOT spent $12,500 to add lockers for eight bicycles.

Lessons learned

13. Factor in time to process permits for installation

King County Metro is working with their installation supervisors to reduce permitting approval to three weeks.

14. Adding bicycle lockers is a relatively inexpensive way to add park and ride space

Adding bicycle lockers was more cost effective than constructing a single parking space, which can cost about $25,000.

15. Bicycle facilities remain once construction is completed

These bicycle lockers remain in use and continue to provide a public benefit long after construction is done.

Promote vanshare

WSDOT contracted with King County Metro to promote residential-based vansharing. Vansharing is the use of a commuter van for a short portion of a commuter's trip between work and a transit connection, or between home and a transit connection (residential-based). This project was King County Metro's first attempt to market vansharing for the home to transit connection trip as part of a construction mitigation effort. The effort was targeted to free up parking spaces at the crowded Brickyard Park and Ride lot in Kirkland, which averaged 110 percent use in 2005 (on average 266 cars parked in the 242 stall lot). Vansharing would also connect with WSDOT-funded transit Routes 644 and 255. The plan was to recruit up to 12 new vanshare groups, which would free up to 36 parking spaces at the crowded Brickyard Park and Ride. As an incentive, King County Metro waived fares and offered a one-time fuel incentive to new groups. Metro promoted the vanshare program at five public events at the Brickyard Park and Ride and 29 employer events across King County's eastside from June to December 2006.

Results

No new vanshare groups were formed, though there was some interest in the program. Due to the low density of the Kenmore, Bothell, and Woodinville residential areas, King County Metro staff had difficulty matching interested participants to form vanshare groups.

Lessons learned

16. Carefully consider where to offer home to transit vansharing

Focus on transit connections in areas with high density residential instead of rural or suburban areas. In this case, commuters showed some interest in vansharing, but King County was not able to generate adequate numbers of travelers with similar origins and destinations to make the service viable.

Incident response

The I-405 Kirkland Stage 1 Widening project required lane narrowing and reduced shoulders. In areas where full shoulders were eliminated due to construction, incidents such as stalled vehicles or minor accidents could not clear to the shoulder and would block a lane of traffic until cleared. By quickly removing blocking incidents from the road, we reduce the chance of secondary collisions occurring, which improves safety and traffic flow on the road. This is especially critical in construction zones where shoulders are limited and workers are doing their jobs close to moving traffic. Based on analysis of incident data the loss of shoulders will result in additional blocking incidents that will restrict capacity during these times. We recommended additional incident response (more than what existed prior to construction) on I-405 during construction to promote faster response and clearance times and improve safety. The incident response team was funded to provide additional services on the I-405 corridor in support of construction activities.

Results

Overall the number of incidents served within the I-405 corridor increased during construction compared to an equivalent period before construction (9,821 to 10,500). There was no change in the average clearance time of 16-minutes per incident. Within the construction zone the number of incidents blocking more than tripled (82 to 248): although the total number of incidents reduced slightly (608 to 567). This is likely the result of drivers not being able to clear to the narrowed shoulders within the construction zone. Average clearance times within the construction zone increased from 12-minutes to 20-minutes. This could be attributed to the increase in the number of blocking incidents which can hinder responder arrival due to traffic back-ups and may take longer to clear.

Lesson learned

17. Incident response improves traffic flow

Incident response is an effective component of maintaining traffic flow and safety within construction zones. The services also provide benefits beyond the construction zone as the additional incident response vehicle roams the entire corridor providing increased assistance.

Commute Trip Reduction

Washington State's Commute Trip Reduction (CTR) Law was adopted by the 1991 Legislature and incorporated into the Washington Clean Air Act as RCW 70.94.521-551. The intent of the CTR program is to improve air quality, reduce traffic congestion, and reduce the consumption of petroleum fuels by working with major employers to encourage employees to commute without driving alone. Employers with 100 or more full-time employees at a single worksite who begin their workday between 6 a.m. and 9 a.m. must develop a program to reduce their employee's drive-alone trips. CTR benefits such as transit fare subsidies, flexible work schedules, telework opportunities, and more are offered by employers. Worksites may enter or leave the CTR program based on their changing number of employees and the laws governing CTR requirements.

Results

We compared the Kirkland CTR worksites in 2005 (baseline) to 2007. To ensure consistency we compared the same worksites from before (as the baseline) and during construction. We found an additional 333 round trips were reduced on average daily by WSDOT's CTR program during project construction in 2007.

The number of vehicle trips removed through the CTR program is found by taking drive-alone rates for CTR and non-CTR worksites in east King County (77 percent[1]) and comparing them to the drive-alone rates for CTR worksites within Kirkland (68 percent[2]). This results in a conservative estimate since the overall east King County drive-alone rate includes both CTR and non-CTR worksites. With more than 25,000 employees at Kirkland CTR worksites in 2007, the reduced drive-alone rate for CTR sites overall equals about 2,250 round trips reduced daily.

Although this program was not funded by I-405 construction mitigation funds, it provided benefits to the corridor during construction and beyond.

Vanpools

Twenty-two transit agencies around the state offer vanpooling as a commute option, with the majority of the daily vanpool riders in the Central Puget Sound. Vanpooling is more flexible than fixed route transit since it costs less to operate and can provide transportation options to employees in areas that have limited or no bus service. Once formed, many vanpools may last for years. Transit staff members are available to help people form vanpools and to keep seats filled so that vans continue to be cost-effective for commuters.

[1] PSRC 2006 Household Travel Survey single occupant vehicle (SOV) rate for work trips for east or south King County. This rate includes CTR and non-CTR worksites.
[2] WSDOT Commute Trip Reduction program.

The Washington State Legislature established the statewide Vanpool Investment Program in 2003 to help reduce traffic congestion, reduce vehicle miles traveled, and improve air quality. This program has helped transit agencies nearly double their vanpool ridership since 2003. WSDOT purchases vans for public transit agencies to operate and works with the agencies and employers in their community to offer incentives to increase vanpool use. Washington State has the largest vanpool program in the country.

Results

During the Kirkland I-405 construction in October 2007, more than 200 vanpools traveled through the I-405 corridor daily, reducing somewhere in the range of 1,000 to 1,500 round trips each day. This is an increase of 130 to 200 daily round trips reduced by vanpools compared to March 2006 before construction began.

Although this program was not funded by I-405 construction mitigation funds, it provided benefits to the corridor during construction and beyond.

Appendix

Add transit service

The new services on Routes 255 and 644 began in the summer of 2006. The daily trip reductions were calculated by taking the difference of the average daily ridership before and after the new services were implemented. Transit ridership is the equivalent of one-way trips so this was divided by two to determine the average daily round trips reduced by the added transit service.

Weekday Ridership on Routes 255 and 644, Summer 2005 - Summer 2008
Data provided by King County Metro

	Daily Riders (one-way trips)									
	Pre-New Service			**New Service**						
Route	Sum 2005	Fall 2005	Spr 2006	Sum 2006	Fall 2006	Spr 2007	Sum 2007	Fall 2007	Spr 2008	Sum 2008
255	2,370	3,130	3,270	3,510	3,260	3,610	3,730	3,600	3,730	3,950
644	-	-	-	150	160	190	230	220	270	360

WSDOT Analysis

	Daily one-way trips			Daily round trips
Route	Average Daily Ridership Pre-New Service (Sum 2005 through Spr 2006)	Average Daily Ridership New Service (Sum 2006 through Spr 2008)	Trips Reduced (Average Daily Ridership of New Service minus Pre-New Service)	Trips Reduced
255	2,923	3,573	650	325
644	0	203	203	102
			Total	427

Promote high occupancy vehicle use

Promotion of high occupancy vehicles was conducted from May 2006 through July 2007. This performance measurement focuses on the promotion of transit which could be measured through changes in ridership. Routes 255 and 644 were excluded from the analysis since their performance is captured in the added transit service section.

Ridership information is presented for both promoted and non-promoted Kirkland area routes for periods before, during and after the promotion activities. The percent increase in ridership for before and after the promotion activities was calculated. The difference between the percent ridership increase for promoted routes over non-promoted was attributed to the promotion activities rather than natural growth or other contributing factors. This difference was applied to the ridership of promoted routes prior to the promotion to quantify the trip reduction. Transit ridership is the equivalent of one-way trips so this was divided by two to determine the average daily round trips reduced.

Average Daily Rides on Routes Serving Kirkland, Summer 2005 - Fall 2006
Data provided by King County Metro

		Daily Riders (one-way trips)				
	Route	Sum 2005	Fall 2005	Spr 2006	Sum 2006	Fall 2006
Non-Promoted Routes	230	1,652	1,643	1,814	1,872	1,809
	234	969	1,017	1,011	1,003	1,045
	236	648	698	773	740	760
	238	669	751	783	764	856
	251	359	350	344	402	348
	254	272	258	288	290	279
	256	237	197	217	256	269
	257	344	378	367	355	312
	265	304	238	275	294	274
	291	93	103	103	103	132
	935	164	166	154	154	182
	952	260	299	277	260	296
	Total	5,971	6,097	6,406	6,493	6,562
		Daily Riders (one-way trips)				
	Route	Sum 2005	Fall 2005	Spr 2006	Sum 2006	Fall 2006
Promoted Routes	237	42	69	69	73	71
	245	1,539	1,712	1,914	1,839	1,997
	252	503	511	525	506	468
	260	148	151	153	139	138
	277	187	263	258	150	237
	342	259	333	355	348	361
	540	1,220	1,621	1,593	1,322	1,536
	630	214	277	244	278	243
	Total	4,112	4,937	5,111	4,655	5,051

WSDOT Analysis

	Daily one-way trips		
	Average Daily Ridership Before Promotion (Sum 2005)	Average Daily Ridership After Promotion (Sum 2006)	% Change Before and After Promotion
All Non-Promoted Routes	5,971	6,493	109%
All Promoted Routes	4,112	4,655	113%

Trips Reduced Daily (one-way trips)

$$= \left(\left(\begin{matrix}\%\text{Change} \\ \text{Promoted Routes}\end{matrix}\right) - \left(\begin{matrix}\%\text{Change} \\ \text{Non - Promoted Routes}\end{matrix}\right)\right) * \left(\begin{matrix}\text{Average Daily Ridership of} \\ \text{All Promoted Routes Before Promotion}\end{matrix}\right)$$

Trips Reduced Daily (one-way trips)

$$= ((123\,\%) - (110\,\%)) * (4{,}112) = 184$$

Trips Reduced Daily (round trips)

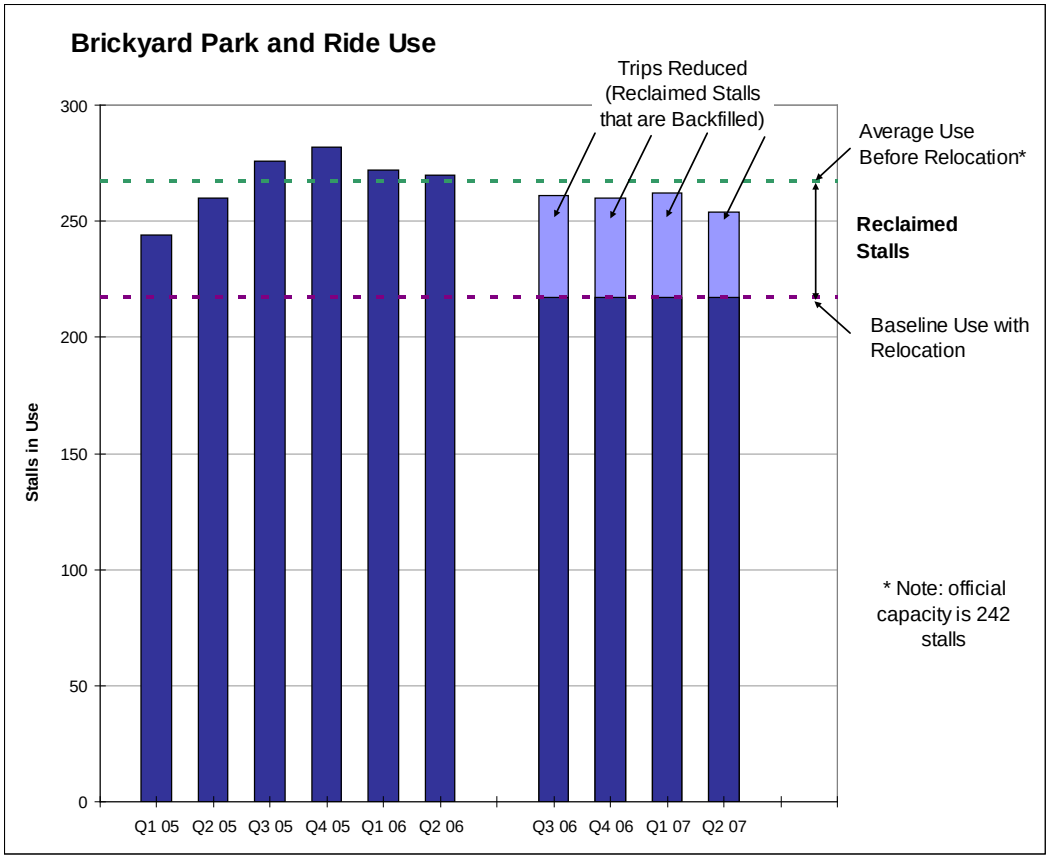
92

Relocate vanpools

Relocation of the vanpools occurred in May 2006 and participants were required to relocate from the park and ride for one year. To calculate the daily trip reductions, you first calculate an average use for a period before the relocation and during the relocation. The average use before the relocation minus the number of individuals relocated provides a baseline use. The trips reduced are the difference between the use during the relocation and the baseline use. This is the number of new users who were able to access the park and ride after the vanpool users relocated.

Brickyard Park and Ride Quarterly Use 2005 - 2007									
Data provided by King County Metro' Quarterly Park and Ride Utilization Reports									
Quarterly Use									
2005				2006				2007	
1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
244	260	276	282	272	270	261	260	262	254
Brickyard Park and Ride's Official Capacity is 242 Stalls									

WSDOT Analysis				
Average Use Before Relocation 1Q 2005 through 2Q 2006	Average Use After Relocation 3Q 2006 through 2Q 2007	Vanpoolers who Relocated from the Park and Ride	Baseline Use (Average Use Before Relocation minus the 50 Relocated Individuals)	Daily Round Trips Reduced (Average Use After Relocation minus Baseline Use)
267	259	50	217	42



Install and promote bicycle lockers

Installation of the bicycle lockers was completed in January 2007 with all lockers available February 1, 2007. King County Metro provided data on locker rentals at various times. We used these data points to extrapolate the rentals both mathematically and based on initial ramp-up related to weather. The lockers became available at a time of year when the weather makes bicycling less popular. Since the park and rides contain a mix of Metro and WSDOT provided lockers, the average number of rented lockers provided by WSDOT was calculated by multiplying the percent of rented lockers by the number of lockers WSDOT provided. The trip reduction was calculated by multiplying this total times the historical use of bike lockers obtained from King County Metro which is 3.5 times per week.

WSDOT Analysis

	Capacity	
	Brickyard Park and Ride	Kenmore Park and Ride
Added Capacity (Funded by WSDOT)	**4**	**4**
Total Capacity	**4**	**8**

The data in the shaded cells was provided by King County Metro.

According to King County Metro the historical use of bike lockers is an average of 3.5 days per week.

		Rented Lockers	
		Brickyard Park and Ride	Kenmore Park and Ride
Construction Period	Feb-07	**1**	*0*
	Mar-07	*1*	*2*
	Apr-07	*1*	*4*
	May-07	*2*	**6**
	Jun-07	*3*	*6*
	Jul-07	*4*	7
	Aug-07	*4*	*8*
	Sep-07	*4*	*8*
	Oct-07	*4*	*8*
After Construction	Nov-07	*4*	*8*
	Dec-07	*4*	*8*
	Jan-08	*4*	*8*
	Feb-08	*4*	*8*
	Mar-08	*4*	*8*
	Apr-08	*4*	*8*
	May-08	*4*	*8*
	Jun-08	**4**	*8*
	Jul-08	*4*	**8**
Average Number of Rented Lockers for Construction Period Only		2.7	5.4
Percent Total Rented		67%	68%
Average # of Rented Lockers Provided by WSDOT (Percent Total Rented times Added Capacity Funded by WSDOT)		2.7	2.7
Average # of Rented Lockers Provided by WSDOT for All Locations			5.4

Trips Reduced Daily (round trips)

$$= \begin{pmatrix} \text{Average \# of Rented Lockers} \\ \text{Provided by WSDOT} \end{pmatrix} * \begin{pmatrix} \text{Historical Use} \\ \text{of Bike Lockers} \end{pmatrix}$$

Trips Reduced Daily

$$= (5.4) * \left(\frac{3.5}{5}\right) = \quad 4$$

Promote vanshare

There are no calculations or data to provide since the program was not able to attract any participants.

Incident response

Area	Period	Number of Incidents	Blocking Incidents	Average Clearance Time
I-405 Corridor Entire Length	March 2004 - October 2005 (Before Construction)	9,821		16
	March 2006 - October 2007 (During Construction)	10,500		16
Construction Zone NE 85th ST (18.45) to NE 124th ST (20.00)	March 2004 - October 2005 (Before Construction)	608	82	12
	March 2006 - October 2007 (During Construction)	567	248	20

Commute Trip Reduction

To estimate the number of vehicle trips removed through WSDOT's ongoing CTR program, we compared drive-alone rates for east King County (includes both CTR and non-CTR worksites) to Kirkland (only includes CTR worksites). This estimate is conservative since the overall east King County drive alone rate includes CTR and non-CTR worksites.

To estimate the vehicle trips removed within the Kirkland area, we took the difference between the east King County drive alone rate and the Kirkland CTR sites' drive alone rate and multiplied it by the number of employees at the Kirkland CTR sites. To ensure consistency, we compared the same worksites from before (as baseline) and during construction.

Kirkland CTR Worksites*

		Number of Employees	Drive Alone Rate	Drive Alone Round Trips	((General East King Cty Drive Alone Rate) - (CTR Site Drive Alone Rate)) * Number of Employees	Change 2005 to 2007
Kirkland CTR Worksites present in both 2005 and 2007	2005	20,504	69.4%	14,233	1,558	333
	2007	21,932	68.4%	14,996	1,892	
All Kirkland CTR Worksites in 2007	2007	25,448	68.2%	17,347	2,248	

General Eastside Drive Alone Rate** 77%

The data in the shaded cells was provided by the Commute Trip Reduction program.

*WSDOT CTR Database: ~2 miles on either side of I-405 from NE 160th in Kirkland to 110th Ave. SE in Newcastle.

**Source: PSRC 2006 Household Travel Survey drive alone rate for work trips for east or south King County. This rate includes CTR and non-CTR worksites.

Vanpools

System wide data was collected for the beginning (March 2006) and end (October 2007) of construction. Specific I-405 corridor data was only available for the end (October 2007) of construction. To estimate vanpools on the I-405 for the beginning of construction, we assumed that the vanpool growth on the I-405 corridor was similar to the rest of the system. Calculating the system wide growth between March 2006 and October 2007, we reduced the October 2007 data on I-405 by this growth to back-out an estimate of the March 2006 I-405 vanpools.

This can be converted to an estimated reduction of round trips using factors for the trips reduced in each vanpool. A high estimate uses the factor of the average ridership of a vanpool minus the driver. A low estimate uses a factor based on a survey of vanpool riders' previous modes to ensure a reduced trip for a rider switching from another alternate mode such as riding the bus or in a carpool is not counted.

The data in the shaded cells was provided by vanpool operators.

		King County Metro	Community Transit	Pierce Transit	Total
Total System	March 2006 Vanpools	741	263	NA	NA
	October 2007 Vanpools	846	302	NA	NA
	Change March 2006 to October 2007	114%	115%	NA	NA
	Average Ridership per Vanpool	8.2			
	High Estimate of Round Trips Reduced per Vanpool (Average Vanpool Ridership minus the Driver)	7.2			
	Low Estimate of Round Trips Reduced per Vanpool (Based on survey data previous mode of vanpool riders)	4.7			
I-405	October 2007 Vanpools	141	65	2	208
	March 2006 Vanpools Estimate	*124*	*57*	NA	*180*
	Round Trips Reduced				
	March 2006 (pre-construction)	High Estimate (# of vanpools times the high estimate of round trips reduced per vanpool)			1,304
		Low Estimate (# of vanpools times the low estimate of round trips reduced per vanpool)			846
	October 2007 (during construction)	High Estimate (# of vanpools times the high estimate of round trips reduced per vanpool)			1,506
		Low Estimate (# of vanpools times the low estimate of round trips reduced per vanpool)			978
	Change in Round Trips Reduced March 2006 to October 2007 High Estimate				202
	Change in Round Trips Reduced March 2006 to October 2007 Low Estimate				131
	Range of Round Trips Reduced	October 2007			978 to 1,506
		Change March 2006 to October 2007			131 to 202
	Midpoint of Round Trip Reduction Range	October 2007			1,242
		Change March 2006 to October 2007			167

Route 644

Washington State Department of Transportation

Route 255 Extension

Washington State Department of Transportation